

# Memorandum

To: JOSEPH PRATT - MS #5  
Office of Structure Foundations  
Division of Structures and Foundations

Date: June 27, 2000  
File: 11-SD-5-KP 49.31  
EA: 11-0301U1

N5/N805 Separation (widen) 11-0301U1  
Bridge No. 57-0512

From: DEPARTMENT OF TRANSPORTATION  
ENGINEERING SERVICE CENTER  
Division of Materials Engineering and Testing Services – MS #5  
Office of Testing and Technology Services

Subject: Corrosion Review for N5/N805 Separation Widening

We have completed our corrosion review of the N5/N805 Separation Widening project outlined in a May 8, 2000 memorandum sent to Doug Parks of the Corrosion Technology Branch. Our review is based on corrosion test results of soil samples, summarized information from the Log of test borings, and Caltrans Bridge Design Specifications 8.22 (May 2000 draft).

## Project Description

The site is part of the Route 5/805 Freeway improvements in San Diego County. The structures consist of a right side bridge widening and left side bridge widening. The bridge abutments will be supported by plumb, 1.2m (4 ft) diameter, Cast-in-Drilled-Hole (CIDH) Piles. The right side bent support widening will be supported by plumb, 2.4m (8 ft) diameter, Cast-in-Drilled-Hole (CIDH) Piles. The left side bent support widening will be supported by plumb, 2.1m (7 ft) diameter, Cast-in-Drilled-Hole (CIDH) Piles. It is the understanding of the Corrosion Technology Branch that permanent steel casings 13mm to 25mm thick (1/2 in to 1in) will be used to avoid problems associated with caving of the holes and filling with groundwater due to aquifer conditions. The steel casings will serve as a barrier against corrosive conditions, however, the steel casings will not serve as part of the structural section of the pile.

## Corrosion Review

Caltrans defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-cm, or a pH of 5.5 or less.

Eight soil samples were taken at the N5/N805 Separation Widening site of the native material, as well as, an additional sample of the embankment fill material. The samples were tested for pH, minimum resistivity, sulfate concentration, and chloride concentration in accordance with CTM 643, CTM 417, and, CTM422. The pH ranged from 7.48 to 7.98. The minimum resistivity ranged from 475 ohm-cm to 1300 ohm-cm. The sulfate concentration ranged from 45 ppm to 6000 ppm. Finally, the chloride concentration ranged from less than 25 ppm to 760 ppm.

The embankment fill and/or alluvial materials are corrosive based on low soil resistivity levels, a high chloride concentration, and a high sulfate concentration. The minimum resistivity values are below 1000 ohm-cm (as low as 475 ohm-cm). The chloride concentration is above 500 ppm (up to 760 ppm). The sulfate concentration is above 2000 ppm (up to 6000 ppm).

### Corrosion Recommendations

In order to maintain a 75-year design life for the structure, we recommend the following corrosion mitigation measures:

- The minimum concrete cover requirements for chloride environments are addressed in Table 8.22.1 of the BDS (May 2000 draft). Given chloride concentrations at the site are between 500 ppm and 5000 ppm, a minimum concrete cover of 75 mm (3 inches) should be used for reinforcing steel for CIDH piles (not inside a steel shell), pile caps, walls, and footings.
- The minimum requirements for protection of reinforced and unreinforced concrete against acid and sulfate exposure shall be in accordance with Table 8.22.2 of the BDS (May 2000 draft). For CIDH piles (not inside a steel shell), footings, pile caps, and walls, the concrete should contain a minimum cementitious material content of 400 kg per cubic meter. Cementitious material shall consist of 75% by mass Type II modified, or Type V portland cement and 25% by mass mineral admixture conforming to ASTM C618 Type F or N (flyash or natural pozzolans). Also, the water-to-cementitious material ratio shall be a maximum of 0.40.
- For CIDH piles inside a steel shell, no additional concrete corrosion mitigation measures are required. The minimum thickness of the steel shells (13mm) is thick enough to prevent chlorides and sulfates from penetrating the inside of the pile during the 75-year design life for the structure.

If you have any questions regarding our comments, please contact Michael Tolin at (916) 227-5297 or Doug Parks at (916) 227-7007.



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Reviewed By:



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